

Engines/Powerplants

The large civil aircraft jet engine market is dominated by a few individual manufacturers and several joint ventures comprised of one or more of these players along with a smaller company or companies. With one exception, the major engine manufacturers are part of diversified corporations¹ producing engines for both civil and military aircraft, either alone or as part of one or more joint ventures.

U.S. and Foreign Manufacturers

Three major manufacturers dominate the large commercial jet engine market.

Company	Products	2009 Revenue (millions)	2009 Income (millions)	2008-2009 % Change in Income
General Electric (Parent of GE Aviation)	Turbofan, turboprop, and turboshaft engines for a variety of civil and military aircraft	\$156,783	\$11,025	(36.67)
United Technologies Corp. (Parent of Pratt & Whitney)	Turbofan and turboprop engines for a variety of civil and military aircraft	\$52,920	\$3,829	(18.34)
Rolls-Royce PLC	Turbofan, turboprop, and turboshaft engines for a variety of civil and military aircraft	£ 10,414 \$16,714*	£ 2,217 \$3,358*	264.83

*At an exchange rate of £1 = \$1.6050

Of the three companies listed above, General Electric Aviation (GE Aviation) and Pratt & Whitney (P&W) are the two largest U.S. manufacturers. The United Kingdom's Rolls-Royce PLC is the largest non-U.S. producer.

¹ In FY 2009, Rolls-Royce civil and defense aerospace segments comprised a combined 64 per cent of the company's total revenues and 73 per cent of its total income. See Rolls-Royce PLC 2009 Notes to Consolidated Financial Statements, available at http://www.rolls-royce.com/reports/2009/img/downloads/Consolidated_financials_notes.pdf

Joint Ventures

The three dominant engine manufacturers also participate in various joint ventures. These ventures are formed to capitalize on emerging market demand for engines, while at the same time allowing partners to share development and production costs along with risk.

Company	Partners and Ownership Percentages
The Engine Alliance	GE Aviation – 50% Pratt & Whitney -50%
CFM	GE Aviation – 50% Snecma Moteurs – 50%
International Aero Engines (IAE)	Rolls-Royce – 32.5% Pratt & Whitney – 32.5% Japanese Aero Engines Corporation – 23% MTU Aero Engines -12%
PowerJet	NPO Saturn JSC – 50% Snecma Moteurs – 50%

- The Engine Alliance, a 50/50 joint venture between GE Aviation and P&W, was formed to produce an engine for the Airbus A380. The Engine Alliance competes directly with Rolls-Royce for A380 engine business holds a roughly equal market share with Rolls-Royce.
- CFM International, a joint venture of GE Aviation and Snecma Moteurs, a unit of the SAFRAN Group of France, produces the CFM56 engine. The CFM56 is used in various Boeing and Airbus aircraft and is the sole engine option for the Boeing 737.
- International Aero Engines AG, a consortium comprised of P&W, Rolls-Royce, German engine manufacturer MTU Aero Engines GmbH and the Japanese Aero Engines Corporation, produces the V2500 engine for use in the Airbus A319/A320/A321 aircraft.
- PowerJet is a 50/50 joint venture between Snecma Moteurs and Russian engine manufacturer NPO Saturn JSC. PowerJet's entry into the jet engine market is significant, as it is representative of the Russian civil aviation/aerospace industry's efforts to compete with U.S., EU and Japanese manufacturers as a viable alternative for commercial aircraft, engines and other components. PowerJet's initial offering, the SaM146 engine, is being developed for use initially in Russian aircraft manufacturer Sukhoi's Superjet 100.

PowerJet is marketing their engine as part of an overall package of customer support and maintenance services for the entire propulsion system to include long-term engine maintenance, parts management by the hour, and engine leasing and exchange programs.² In addition to the Sukhoi Superjet 100, PowerJet plans to develop additional engine variants as well as find additional regional jet customers for their engine.³

With the exception of Rolls-Royce, EU and Japanese engine manufacturers compete mainly through their holdings in joint ventures. Most notably, as a 50/50 partner with GE Aviation in CFM International, Snecma Moteurs of France maintains a significant market presence. In addition, MTU Aero Engines GmbH of Germany, along with the Japanese Aero Engines Corporation, maintains a presence via its equity holdings in IAE.

Since no Russian engine manufacturers currently produce engines for use on Boeing or Airbus aircraft, the impact of Russian jet engines on the LCA jet engine market is negligible at the time of this report. As discussed above, however, Russian manufacturers are looking to participation in joint ventures such as PowerJet in order to gain access to the global aircraft engine market.⁴⁵

China possesses a growing cadre of small domestic aircraft engine parts manufacturers, along with a number of established major manufacturing entities. In addition, China is taking steps to raise the profile of its domestic jet engine manufacturing capability. In January, 2010, the China Aviation Industry Corporation, a shareholder in the state-owned Commercial Aviation Corporation of China (COMAC), began construction of a research and development center in Shanghai to develop engines for domestically produced civil aircraft. COMAC officials have stated that their goal is to eventually use domestically produced engines to power COMAC's ARJ21 regional jet and C919 narrow-body airliner; however, the ARJ21 and C919 will initially feature engines manufactured by GE Aviation and CFM International.⁶⁷

Market Trends

Market trends in the aircraft engine market are linked to aircraft sales. With the notable exception of Boeing's 737, Boeing and Airbus typically have two engine options for each model offering. The same arrangement exists for most regional jet aircraft. Therefore, an end user-customer could, and often does, purchase a U.S.-manufactured Boeing 747 aircraft and equip it with UK-manufactured Rolls-Royce engines. Similarly, customers may choose to equip Airbus aircraft such as the A330 and A320 with P&W and CFM56 engines respectively.

² <http://www.powerjet.aero/?id=222&selt=1>

³ <http://www.powerjet.aero/?id=190&selt=1>

⁴ Industry Analysis of Aircraft and Aircraft Parts Sector in Russia, U. S. Department of Commerce October, 2002, available at <http://www.bisnis.doc.gov/bisnis/isa/021001RusAir.htm>.

⁵ "Powerplant: PowerJet has won over sceptics by delivering a Western-standard engine with Russian help", available at <http://www.flightglobal.com/articles/2007/02/06/211877/powerplant-powerjet-has-won-over-sceptics-by-delivering-a-western-standard-engine-with-russian.html>

⁶ "C919 Engine Plans Take Shape", available at <http://www.airshow.com.cn/en/Article/yjxx/2010-01-15/11243.html>

⁷ "AVIC Commercial Aircraft Engine Co. Ltd. Builds R&D Center for Jumbo Jet Engine", available at <http://investing.businessweek.com/research/stocks/private/snapshot.asp?privcapId=52297984>

GE Aviation, Rolls-Royce and CFM⁸ currently lead the LCA jet engine market on both a unit and total value basis. CFM's strength in the market is driven by current and projected continued high unit sales of the CFM56 engine. The CFM56 is the sole engine choice for the entire Boeing 737 series, and it is also used in a number of Airbus aircraft. As neither Boeing nor Airbus have divulged any plans to replace their single-aisle (e.g. 737, A320) aircraft in the near term, the large number of 737 and competing Airbus aircraft in service means deliveries of the engine should remain high for the foreseeable future.

By comparison, GE Aviation and Rolls-Royce's current strength and projected growth are predicated upon higher per unit engine prices. GE Aviation's market share is largely built on deliveries of its CF6 and GE90 engines, which power the Boeing 747, 767, and 777 as well as multiple Airbus aircraft. Rolls-Royce's market position is based upon sales of the company's Trent series of engines, which are used in the Boeing 747, 757, 777 and 787 Dreamliner and Airbus A330, A340, and A380. Rolls-Royce is also developing the Trent XWB engine for the redesigned A350XWB.

P&W's position as the second largest aircraft engine manufacturer in the United States is increasingly based on its revenue from military sales as well as its commercial aftermarket services. Two of the company's most promising aftermarket services offerings are its Global Material Solutions business unit, which offers maintenance, repair and overhaul (MRO) services for the CFM56 engine offered by its competitor CFM, and EcoPower, a closed-loop, environmentally friendly engine wash service that yields improved engine fuel economy and performance.

P&W's most promising new product is its geared turbofan (GTF) engine, designated the PurePower PW1000G. The PW1000G offers significant fuel consumption savings over similar size engines, and the company is working with NASA to demonstrate the engine's ability to use alternative, non-petroleum based aviation fuels.⁹ The PW1000G has been selected as an engine option for Russia's United Aircraft Corporation/Irkut MS-21 and as the sole engine choice for Japan's Mitsubishi Regional Jet (MRJ) and Canada's Bombardier C-Series aircraft.¹⁰

P&W currently leads the market in terms of number of engines in service, but the company's lead is projected to give way to competitors as newer engine models begin service and older model aircraft are retired. The effect of this competition is mitigated somewhat by P&W's partnership in both the Engine Alliance and IAE. From these cooperative efforts, P&W still stands to benefit from the introduction of new aircraft and engines.

⁸ For purposes of this analysis, CFM deliveries are counted separately from those of GE Aviation, which owns 50 per cent of CFM. However, revenue from CFM deliveries is shared on a 50/50 basis by GE Aviation and Snecma Moteurs.

⁹ "Pratt & Whitney's Geared Turbofan(TM) Engine Demonstrates Alternative Fuel Capabilities" available at <http://www.portfolio.com/resources/company-profiles/UTX/press/2008/02/19/pratt--whitneys-geared-turbofantm-engine-demonstrates-alternative-fuel-capabilities>

¹⁰ <http://www.pw.utc.com/Products/Commercial/PurePower+PW1000G>

Outlook

The overall outlook for the global jet engine market is for increasing cooperation among manufacturers resulting in more joint ventures and, in the case of EU-based/Euro-denominated manufacturers, production shifts towards lower-cost, dollar-denominated countries.

The prevalence of joint ventures in the aircraft engine industry will continue. New mergers like the PowerJet venture between Russian manufacturer NPO Saturn JSC and Snecma Moteurs of France will continue to form as the next generation of narrow-body aircraft come online, augment and ultimately replace existing aircraft. In addition, P&W will use its own joint venture channel to market its PW1000G engine through membership in IAE. German manufacturer (and fellow IAE member) MTU is working closely with P&W on product testing.¹¹ P&W is also considering adding additional partners to the team developing the PW1000G engine. In addition to IAE partner MTU and Volvo Aero, Singaporean maintenance, repair and overhaul company SIA Engineering Co (SIAEC) became a risk-sharing partner in January 2010.¹²

Anecdotal evidence from various U.S. engine manufacturers indicates that Airbus has begun linking aircraft sales to engine selection. More specifically, Airbus has begun to rely on a “package” of Airbus aircraft and Rolls-Royce engines. The package price is contingent on the end-user/customer selecting Rolls-Royce engines in conjunction with the Airbus aircraft at the time of purchase. Previously, engine selections were not typically linked to the aircraft selection and purchase, and the customer was free to make the engine selection on factors such as acquisition cost, fuel efficiency, MRO availability and life-cycle costs. Generally, Rolls-Royce’s aircraft engine sales proposals focus more on acquisition cost and less on the downstream expenses involved with MRO and overall life cycle. Therefore, an EU aircraft and engine pair (e.g. Airbus/Rolls-Royce) provides the pair with bargaining leverage. Although the same opportunity may exist for packaging U.S.- made aircraft and engines together, this trend will almost certainly prove more challenging to U.S. engine manufacturers, as they are much more focused on the downstream cost benefits of their engines and typically do not compete solely on an acquisition cost basis.

Notable Developments

The creation of an open joint stock company by the Russian Federation consolidating many of the state-owned aerospace companies under a single entity could influence the future landscape of the global jet aircraft engine business. This consolidated entity, the United Aircraft Corporation (UAC), has moved quickly to transform and revitalize the Russian aviation industry and has positioned itself as both a formidable competitor and potential partner in the global aviation market. Partnerships such as the PowerJet joint venture, as well as future cooperation

¹¹“ Pratt & Whitney Begins Final Assembly of Geared Turbofan Demonstrator Engine” available at <http://www.pratt-whitney.com/vgn-ext-templating/v/index.jsp?vgnextoid=2e35288d1c83c010VgnVCM1000000881000aRCRD&prid=fb5988c63af33110VgnVCM100000c45a529f>

¹² “SIA Engineering Invests in PW1000G Engine”, available at http://www.aviationweek.com/aw/generic/story_channel.jsp?channel=mro&id=news/awx/2010/01/21/awx_01_21_2010_p0-198616.xml

between the United States, EU and UAC on development of next generation civil aircraft will certainly open up new business opportunities for the aircraft engine industry.

Over the longer term, development of the Chinese large civil aircraft industry will certainly have an impact on the global aircraft engine business. Chinese aviation industry and government officials have acted upon their stated intent to produce indigenously designed and manufactured civil aircraft with development of the ARJ21 regional jet and C919 narrow-body airliner. China is also taking steps to develop its domestic jet engine manufacturing capability to power Chinese designed and manufactured aircraft. As China does not yet produce a suitable engine in the size and thrust range for an LCA application, the possibility exists for direct engine sourcing as well as collaboration and/or joint ventures similar to those described above.¹³

Currency movements will also affect the market outlook. The general downward trend of the dollar against the pound and the euro has compelled Rolls-Royce to shift its industrial base away from the United Kingdom to lower-cost, dollar-denominated markets. In 2008, Rolls-Royce CEO Sir John Rose noted:

"Ninety per cent of our revenue comes from outside the UK, and the manufacturing balance will continue to move that way... Over time we will increasingly ensure that our supply chain is either dollarized or low-cost so that we can get a hedge against the dollar." ¹⁴

Rolls-Royce already manufactures turboprop engines through its U.S.-based subsidiary Rolls-Royce North America, Inc. and further shifts toward dollar-based production would make Rolls-Royce products increasingly price competitive against U.S. manufactured engines and less exposed to currency fluctuations.

¹³ "China to develop large commercial aircraft by 2020" available at <http://www.iht.com/articles/2007/03/12/business/jet.php>

¹⁴ "Rolls-Royce to shift production away from Britain" available at http://findarticles.com/p/articles/mi_qn4158/is_20080208/ai_n21280488?tag=content;col1